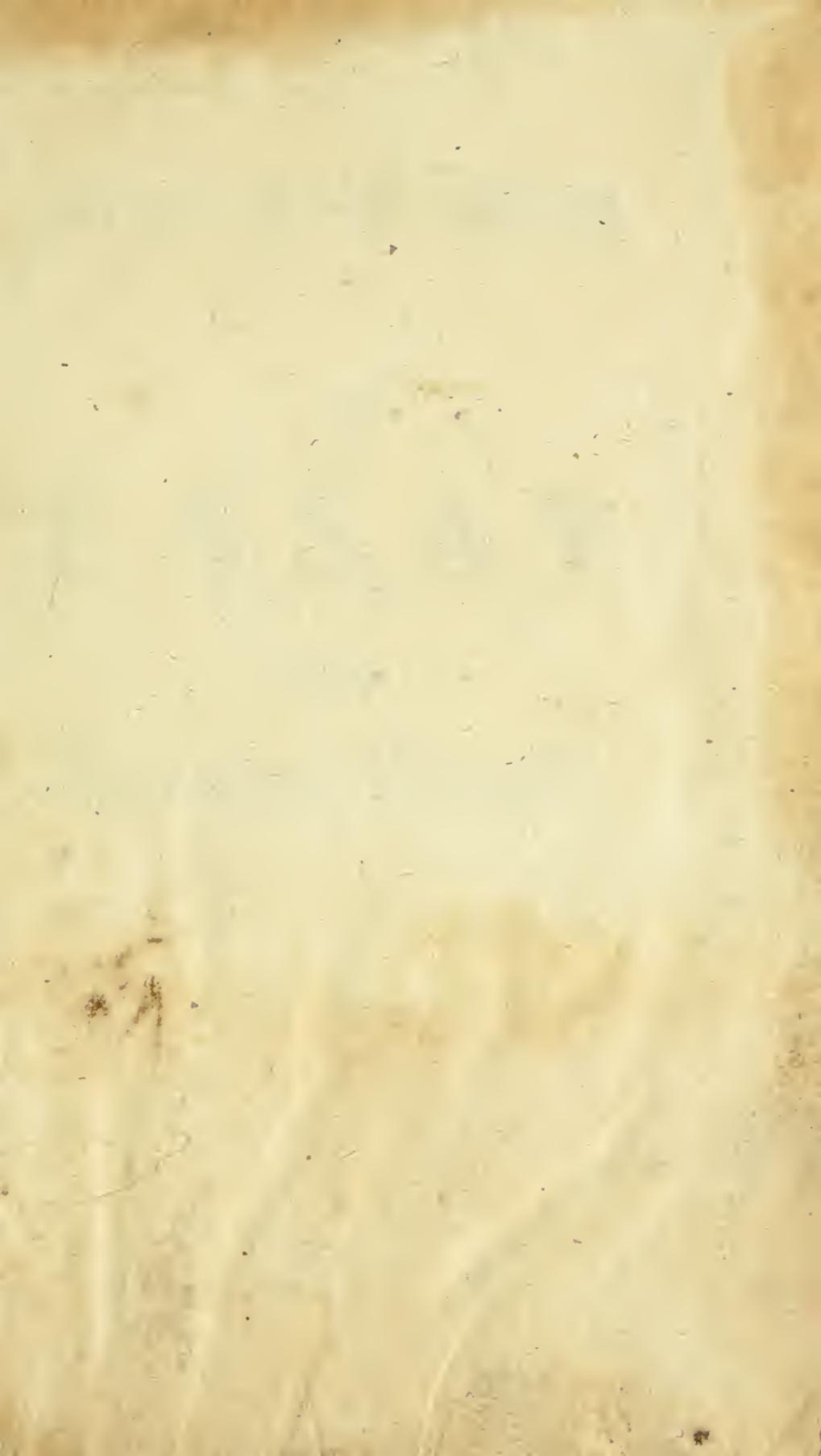


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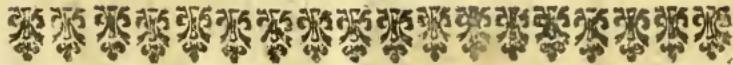


A N

E S S A Y

O N

Contagious Diseases.



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A N *Mectoris*

ESSAY

ON

Contagious Diseases:

More particularly

On the Small-Pox, Measles,
Putrid, Malignant, and Pestilential Fevers.

By *Clifton Wintringham.*

TO R K :

Printed by *Charles Bourne* for *Francis Hildyard*, and are to be Sold by *W. Taylor*, at the Sign of the Ship in Pater-noster-Row LONDON, 1721.

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THE PREFACE.

THE Design of this small Treatise being to deduce the Causes, and explain the Phœnomena of some of the most Fatal Diseases which afflict Mankind, can stand in Need of no Excuse, whatever the

(a 2) Per-

iv The Preface.

Performance it self may ; and especially at a Time, when not only several of them Rage amongst us with uncommon Violence, but we are Daily threatned with the dreadful Calamity of a Raging Pestilence. I have endeavour'd to reduce these Diseases to the same Simplicity with Others, to speak Intelligibly of them, and show the real Changes in the Animal Oeconomy, from the Principles of the Modern Philosophy.

The

The Learned Authors who have already wrote on this Subject, have rejected this Part of it, as being so easie and obvious as to need no Explanation. I doubt not indeed but this is their Case: But how easie soever it may be to explain these Phœnomena, 'tis not every one, conversant in the Practice of Physick, that will give himself the trouble to deduce them; and 'tis for such chiefly that this small Tract is designed; to whom

vi The Preface.

whom if it prove any way serviceable, I shall gain the End I proposed by it.

York, June 1st.
1721.



E R R A T A.

PAGE 8. Line 20. before Contagion insert a Pestilential. PAGE 52. Line 17. read Buboes.

O F



O F

Contagious Diseases.

C H A P. I.

Contagious Diseases are generally defin'd by Physicians to be such, as are capable of being communicated to us by the Air, or the Effluvia of Morbid Bodies. When the Cause producing these Diseases is general, and not occasioned by the peculiar Qualities of particular Places, but brought from Abroad, they are stiled *Epidemic*.

A

The

Of Contagious Diseases.

The Causes therefore of these Diseases must either be generated in the Air, or produced from the Effluvia of Animal, Vegetable, or Mineral Substances floating in it. And consequently the Effects of the Contagious Particles must be extreamly various, according to the Qualities of the Bodies from which they are produced.

When any of these Causes is of so deleterious a Nature, as not only to be Infectious, but to destroy all or most of those that are affected by it, That Disease is called a Pestilence.

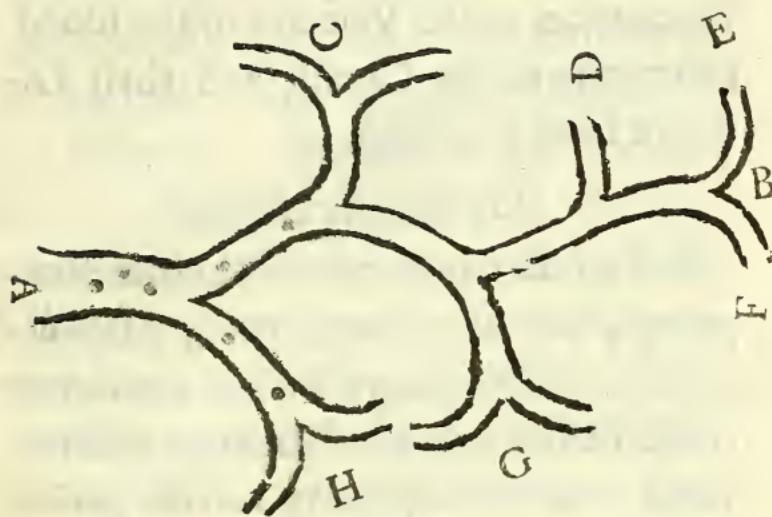
But before I proceed to examine the particular Properties and Effects of the Contagious Particles, it will be Necessary to Demonstrate the following Propositions.

P R O P. I.

The Magnitude of the Particles of the Blood being increased, Obstructions will be formed in the Ramifications of the smaller Vessels, which will happen sooner or

or later, in Proportion to the increased Magnitude of the Particles, and the smallness of the Vessels.

Demonstration.



Let the Canal A be an Artery of a middle Size, sending out the Branches C, D, E, F, G, H; Let the Dots represent the increased *Moleculæ* of the Blood, it is evident that these must be stopt some where or other in the Ramifications of the Vessels C, D, E, F, G, H, whenever the Diameters of the *Moleculæ* exceed those of the containing Vessels.

P R O P. II.

The Magnitude of the Particles of the Blood being increased, those Capillary Vessels nearest the Heart will be soonest obstructed, and *vice versa*; The rest in Proportion to the Velocity of the Blood, Diameters of the Canals, and their Distance from the Heart.

Demonstration.

This is sufficiently evident from the foregoing; For the sooner those *Moleculæ* arrive at the Capillary Vessels, the sooner those Vessels will be obstructed, and *vice versa*, and consequently *cæteris paribus* the Capillaries of the Branches C, H, in the preceeding Figure, which are nearest the Heart, will be sooner obstructed than those of E, F.

P R O P. III.

The Magnitude of the Particles of the Blood must be increased either by the Union of a greater Number of them than in a Natural State; Or by the Alteration of their Figure, by which their Surfaces become larger than before,

De-

Demonstration.

This is evident from the Observations of *Lewenhoeck* and *Malpighius* on the perspirable and other ultimate Vessels, which are visible by the Microscope, and consequently larger than the Orifices of the Lacteals, which the best Glasses will not discover. Whence it will follow, that no Particle can pass this way into the Blood, which single can obstruct the Vessels, and consequently this Effect can only be produced by the Action of the Particles upon each other, *viz.* either by the Union of a greater Number, or some Alteration in their Figures, whereby their Surfaces become larger than before. Thus the Globules of the Blood as appears by the Microscope, are nearly of a Spherical Figure, which being the most capacious, as well as most apt to constitute a Fluid Body, by touching in the fewest Points The farther any Particles deviate from this Figure, the more likely they will be to obstruct the Vessels, and *vice versa.*

P R O P. IV.

The Contagious Particles being admitted into the Blood, do there coagulate its Parts, and form *Moleculæ* of a larger Size than ordinary.

Demonstration.

The Force of the Heart and Cavities of the Canals being the same, when the Infection is first taken, as before, the Blood would pass with the same Facility thro' the Vessels as at other Times, and Obstructions could not be formed, were not the *Moleculæ* thus increased; as our Senses show they are by the Eruption of Pustules in the Small-Pox, by the great Inflammations, Mortifications, Buboes, and Carbuncles in Malignant and Pestilential Fevers; and consequently the Contagious Particles do increase the Bulk of several of the constituent Parts of the Blood, by altering the Figures of its Particles, and forming *Moleculæ* of a larger Size than in a Natural State.

C H A P. II.

IT has been the constant Observation of Physicians, as well ancient as modern, and confirm'd by numerous Instances, that a hot and moist Constitution of the Air, joyn'd with southerly Winds, was generally a Fore-runner of malignant and Pestilential Fevers. Thus *Hippocrates* observes, that the Constitution of the Air preceding that malignant Fever describ'd in the 3d Book of his Epidemics, ' was calm, moist, and southerly, and succeeded a hot, and dry Season; the Winter, calm, cloudy, rainy, warm, southerly; some Showers, and Northerly Winds about the Equinox; the Spring, calm and southerly, with great Rains; the Summer very hot, with little Wind, and much Rain about the Dog-days (a). Some Authors led by the Title of this

(a) *Hippoc.* Epidem. lib. 3. sect. 3. *Galeni Com.* in hunc Loc. *Titi Lucret.* lib. 6.

Book of his Epidemics, viz. *Kalasaria; Aσθετικής*, or the Pestilential Constitution, have imagin'd the Diseases here spoken of, to be the same with that terrible Plague describ'd by *Thucydides*, which taking its Rise in *Aethiopia*, and passing thence thro' *Lybia* and *Egypt*, miserably harass'd all *Persia*, *Phoenicia*, *Judea*, *Greece*, and *Cæle Syria*, and was one of the most dreadful Calamities of this kind that ever appeared in the World. But whosoever will give himself the Trouble to compare the Symptoms of the Fevers here described by *Hippocrates*, with those related by that accurate Historian (b), who both had it himself, and visited many others in it, will find that there is not the least Similitude between them. The one being highly infectious, and not the least Appearance of Contagion in the other: *Galen* also the best Interpreter of *Hippocrates*, in his Comment on this Book of his Epidemic's suspects, this Title

(b) *Thucydides lib. 2.*

to be spurious, tho' both he and others observe much the same Constitution of the Air to be the Fore-runner of these Diseases:

Pestilential and Malignant Fevers, are *What Places* ^{ces most} observed to be the most frequent *subject*. in those Places where the Climate is hot and scorching, and especially when Rains fall in such Seasons of the Year. Thus in *Egypt* and some other Parts of *Africa*, if Rains fall during the Months of *July* and *August*, the Plague usually breaks out the *September* following (c).

This is still more remarkable in such Places, as not only are Situated in the forementioned Climate, but are likewise deprived of a constant Succession of pure and clear Air. An Instance of this we have in *Grand Caire*; which besides being subject to the common Disadvantages of the Country, (as are a Climate hot and scorching, a Situation low and

(c) *Joan. Leon. Hist. Afric.* lib. 1. cap. 10.
Purchas Pilgrim. lib. 6. cap. 17. *Atban. Kircheri Scrutin. Pestis,* pag. 179.

flat, expos'd chiefly to the warm Winds; their Water fetid and stagnating, being reserv'd in Vaults and Canals, which are Annually fill'd by the Overflowing of the River, the Air abounding with putrid Steams and Exhalations, arising from the Parts of Animals, Vegetables, and other Substances brought down and there deposited by the River), lies close under the Hill of the Castle, by which all Wind and Air is intercepted, which causes such a stifling Heat there, as ingenders many Diseases (d).

That these may justly be esteem'd the Causes of the greater Frequency of these Diseases in this Place, than others in the same Climate, appears from their being so rarely known in those Places, which tho' equally hot, enjoy an Air free from Vapours (e). Thus in *Numidia* and some other Parts of *Africa*, the Plague is scarce to be found once in a hundred Years, and hardly at all in the Land of *Negroe* (f).

(a) *Therenot's Travels*, Part. I. pag. 128.

(e) *Piso Hist. Ind. & Brasil.*

(f) *Purchas Pilgrim.* lib. 6. cap. 13.

The other Observations of the Causes of these Fevers, may be reduced to such as arise from the Stinks of stagnating Waters in hot and close Weather, to some putrid Exhalations of the Earth, to the Parts of Animals and Vegetables putrifying in the open Air, or the taking of corrupt & unwholsome Nourishment. Several
Causes of
the Plague.

Of the first kind was that at *Selinis*, occasioned by the stinking Exhalations of the stagnating Waters adjacent, which the discerning *Empedocles* removed by scouring its Ditches from their Filth, by a fresh Current of Water drawn from two Rivers in the neighbouring Country (g).

To the second Class may be reduced that Pestilential Fever, which the same great Philosopher check'd at *Agrigentum*, by stopping the Mouths of some neighbouring Mountains, whose pernicious Fumes had infected the adjacent Country (h); As also that mentioned by *Ammi-*

(g) *Plutarchi Lib. περὶ πολυπραγμοτύπης.*

(h) *Diog. Laert. in Vit. Emped.*

anus Marcellinus, which broke out in *Selucia*, and over-ran a great Part of *Greece*, *Italy*, and *Parthia*, and took its Rise from the opening of an old Vault in the Temple of *Apollo*.

To the Third belong, such as are occasioned by the Parts of Vegetables and Animals, especially those of Men, putrifying in the open Air. As was that mention'd by *Livy*, which over-ran a great Part of *Italy*, and owed its Rise to the dead Bodies of the *Romans* and *Fidenates* left unburied in the Field of Battle (i). Analogous to this was that which from the same Cause appeared in *Germany*, *Anno 1630*; And likewise that mentioned by *Ambrose Parree* from the same Cause; as also that mentioned by *Diodorus Siculus*, occasioned by great Quantities of Locusts driven by Winds into the Sea, and thence cast up in Heaps on the Shore. To this likewise must be reduced those Malignant and Pestilential

(i) *Tit. Livii Hist. Roman.*

Fevers, which so frequently attend Camps and Seiges, especially in the hot Eastern Countries, whose numerous Armies frequently feel the dismal Effects of these stinking Fumes: As do likewise the vast Caravans of the *Mahometans* in their Annual Pilgrimages to Mecca.

To the last belong those Pestilential Fevers, which take their Rise from a preceding Famine, as was that in Judea in the time of *Herod* (k), in which the Product of the Ground being consumed by the great Heat, and long Drought of the preceeding Summer, the poorest sort of People were obliged, thro' the Scarcity of Provisions, to make use of such Food as afforded unwholesome and putrifying Juices.

(k) *Joseph. Antiq. Judeor.* lib. 15. cap. 12.

C H A P. III.

THE Changes wrought in the Animal Oeconomy from the above-mention'd Causes, may be reduced to such as depend either on the Increased Heat of the Air join'd with its Humidity; Or to such as are produced from the particular Qualities of the putrid and Contagious Particles floating in it; Or to the united and complicated Effects of all together.

Effects of a hot and moist Air. The Alterations produced in the Body from a greater Heat continually surrounding it, provided it be not Excessive, are a Rarefaction of the Juices, and Relaxation of the Fibres on the Surface of the Body, and greater Derivation of the Fluids that way. Whence proceeds a large Evacuation of the perspirable Matter. This being continued in a greater Proportion than in a Natural State, will gradually deprive the Blood of

of its Aqueous and Spirituous Parts, and leave the remaining serous Part more stock'd with acrid and pungent Salts, and the Gross, Terrestrial, Oleaginous, and Viscous Particles more firmly united by their nearer Approach, and stronger Cohesion to each other. This greater Heat or Quantity of Fiery Particles, continually surrounding the Body, will necessarily insinuate it self into, and unite with the Saline, Sulphureous, and other Particles, in the same manner as we see it does with other Substances, both Solid and Liquid (1); And likewise by increasing the Velocity of the Circulation and Attrition of the Particles against each other, render them on these Accounts also more Volatile, Pungent and Stimulating, and consequently the Blood will consist of Particles more gross and inspissated or coagulated, and likewise of those of a more acrid and pungent Disposition than in a natural State.

(1) Boyl's Experm. Nov. de Pond. Ignis & Flam. Newtoni Optic. Quæst. 21 & 22.

The Blood being in this depraved Condition, the rest of the Animal Juices must degenerate in Proportion thereto; and the Nervous Fluid, as it consists of the most volatil and subtil Parts, be extremely acrid and pungent, as well as unequal in its Texture and Fluidity, from the more viscous Parts contain'd in it.

*Puerid Fe-
vers how
produced.* This then being the State of the Blood and other Juices of the Body, it is easy to perceive how from very Slight, and otherwise trivial Occasions, a Fever of a very Malignant Nature may be produced. Thus the perspirable Matter from a slight Cold taken being retained, or the Vessels any otherwise filled by Irregularities in Diet, or others of the Non-naturals, the Weight of the moving Fluid will be increased, and the Circulation be more languid and slow. Whence the intestine Motion of the Particles of the Blood being diminished, the viscous Parts will cohere more strongly and in greater Quantities than before, and obstruct the Capillary Arteries, especially in the

the Extremities, and a Coldness, Stretching, Yawning, Torpor, &c. necessarily succeed, the constant Attendants of a beginning Fever; All which will bear a Proportion to the Quantity retain'd, and the Viscosity of the moving Fluid.

These Disorders will necessarily be increased on account of the Air's Spring being weakned by its Heat, the Vessels of the Lungs being less inflated, and the Globules of the Blood less broken and divided, and the more especially in a humid Air, Heat and Moisture necessarily relaxing the Tone of the Fibres and Vessels, and rendring them less Springy and Elastic. Hence then the Quantity of Spirits being diminish'd, and their Motion more slow, the Contraction of the Heart and other Muscles will be more weak and languid, and being stimulated by the Acrimony of the Circulating Liquors, must contract more frequently than in a Natural State; The Consequence of which is Weakness, Faintness, Thirst, and Dejection of Spirits.

These and the preceeding Symptoms will neceſſarily continue, 'til such time as the gross and viscous Matter, being shook and loſen'd by the Action of the Capillary Veffels, is waſhed away into the Veins by the force of the Circulating Fluids, and there continues its Course with the rest, 'til it be either attenuated and ſecreted, or lodged again in the Ca-pillaries to excite new Disorders.

Malignant Fevers.

Now if to this evil Dispoſition of the Air be added a number of pungent ſtimulating Particles, whether bred in the Body or floating in the Air, and thereby communicated to the Blood, which are apt to coagulate the Animal Juices, ſo as to form *Moleculæ* of ſuch Shapes and Sizes as more firmly obſtruct the Capillary Veffels, and at the ſame time ſtimulate and corrode the nervous Parts; It will neceſſarily happen, that the preceeding Symptoms muſt be highly exasperated, and a Fever of a much worse Nature produc'd.

Hence

Hence then must follow a violent Hurry and Colluctation of the Fluids, the Viscid and coagulated Parts of the Blood in some Parts obstructing the Circulation of the Juices, and the Acrid, Volatil, and Fiery Parts, rarefying and dissolving others of the more Liquid, to the greatest degree of Pungency and Volatility imaginable.

Hence it is easy to perceive how the Motion of the Blood must necessarily be in some Parts more languid, by the Cohesion of the more Viscous parts, in others quicker, join'd with a pungent and stimulating heat, from the increased Velocity and Acrimony of the moving Fluid, and the various Actions of the Particles upon each other, and their Impulses on the containing Vessels ; As also how these are capable of almost infinite Variations, in Proportion to the different Quantities and Qualities of the constituent Particles. Hence then appears the Reason of that wandering and uncertain Heat and Coldness, in different Parts of

the Body at the same time. Hence appears the Reason of that great Inquietude and Anxiety, of those uncertain and partial Sweats, Watchings, Tremors, stretching Pains of the head, and the like, as will be more fully shown hereafter.

But before I proceed to explain the Nature of a Fever truly Pestilential, it will be necessary to observe, that notwithstanding the foremention'd putrid Disposition be generally a Prelude to a Pestilential Constitution of the Air, yet it has never that I know of been observ'd, that these Causes alone at their first Onset, produced a real Plague or Pestilential Contagion, without the Concurrence of some preceeding Infection, either brought from abroad, or gradually augmented from the increased Putrefaction of the Air, and Poisonous Steams of Morbid Bodies.

Thus the putrid Air of Camps in hot Countries is frequently found to produce Pestilential Fevers, but this never happens at their first Onset; The Diseases

seases first appearing being Fluxes, Putrid, and afterwards Malignant Fevers; which being exasperated and propagated by the Virulent Effluvia of Diseased Bodies, and the increased Putrifaction of the Air, grow up gradually to those of a Pestilential, and exceedingly infectious Disposition.

Now Putrifaction being only a kind of Putrifaction & Fermentation, wherein the Particles of a putrifying Body are put into an intestine Motion, and by their Action and Attrition broken and divided, and since all fermenting Substances do emit vast Quantities of small separable Parts, it will necessarily follow, that the most subtil and active Particles of the Putrifying Body will be elevated into the Air, and float in it.

These Effluvia consist of the finest and most volatil saline and oleaginous Particles, highly attenuated and set at Liberty from the gross Oil and Terrestrial Part, as appears from the Distillation of such Substances, all which afford great

great Quantities of a pungent and volatile Salt. It is likewise observable, that the subtil Oleaginous Particles being specifically lighter, as well as more easily attenuated and divided than those of a Saline Nature, will be thrown off in greater Proportion in the beginning of the Fermentation or Putrifaction than the heavier Salts will be, which must either be more attenuated and volatilised, or require a greater force to raise them into, and sustain them in the Air than the former, and consequently the greatest Emission of these saline Particles will be after the Fermentation has been for some time continued ; As we find it happens in all fermenting Liquors, as Wine, Beer, Cyder, and the like. All which emit, during the Fermentation, greater Quantities of Particles of an active attenuated Oil or Spirit for some time, than of a Saline Nature, which requiring a longer time in order to attenuate them, are not raised till the former are in a manner quite exhaled, as appears from col-

collecting the Steams of fermenting Liquors, and of those which are turn'd sower by Distillation, and consequently the Exhalations arising from putrifying Bodies will after some time consist mostly of Saline Particles highly attenuated and volatilised, and those not wrapt up and sheathed in the Oily ones, and thereby render'd innocuous, and often useful to the Body, but naked and exceedingly acrid and poignant.

How unfit an Air stock'd with these kind of Particles is for Respiration, appears from several of Mr. Boyl's Experiments on Animals, shut up with putrified Air in the Receiver, most of which with incredible Inquietude die sooner than in *Vacuo*, as also from the pernicious Effects of the Steams of Vaults, Mines, the *Grotto de Cane*, and such like. But besides this Inaptitude of such Air to expand the Pulmonary Vessels, these minute and pungent Particles may be considered as so many *Stimuli* or Lancets, acting upon and penetrating the Coats of the Stomach

mach, Lungs, and other Vessels. On which Account they are not only capable of creating great Disorders, as Inflammation, Pain, Sicknes, Anxiety, Vomiting, &c. in the Stomach and Nervous Parts; But likewise being carried immediately into the Blood, will there stimulate the ultimate Vessels, ferment, dissolve, or coagulate the circulating Juices according to the particular Qualities and Quantity of the Contagious Particles. Nor is it unlikely, that from the various Action of the Particles upon each other, and their different Combinations in a stagnating Air, Particles may be formed of Qualities vastly differing from, and in their Force almost infinitely exceeding those of their Primogenial Salts and first Principles, as in Sublimate, some Preparations of Antimony, &c. Instances of which those versed in Chymistry are no Strangers to.

*Infectious
Particles
how pro-
duced.* Now supposing the Blood Saturated with these kind of Particles, and a Malignant Fever produced by their means,

We all know that the Blood in this State throws off vast Quantities of subtil and active Particles thro' the Perspirable, Salival, and other Excretory Ducts of the Body, which not only must load the adjoining Air with great Quantities of them, and render it capable of producing more dismal Effects than the preceeding, but also the Particles thus thrown off must be endued with a more acrid and pungent Disposition than the former, inasmuch as they are more subtilly divided and attenuated by the Force of the Fever, than those in the preceeding Disposition of the Air, where so powerful an Agent was wanting, And consequently produce a Fever of a most infectious and deleterious Nature; And especially when the Infection is taken toward the latter end of the Disease, at which time the Saline Particles will be more exalted and volatilised, as well as thrown off in greater Quantities, and thereby made more capable of producing an infectious Contagion:

For the Blood in these Circumstances may not unaptly be compared, as was before hinted, to a fermenting Liquor, whose Parts being constantly in Motion, are continually throwing off great Quantities of subtil and active Spirits, capable of exciting the same Fermentation, and producing the same Qualities in those of the like Species, as appears from our manner of fermenting Ale, Beer, &c. with Yeast, which is a Spirituous Ferment, and also from the Sower Ferments used in making Vinegar, &c.

Analogous to this we may observe, that the Blood in different Diseases, as well as different Animals, throws off great Quantities of active Particles, which when mixed with the Blood of a Healthful Person, are capable of exciting the same Fermentation and Disorder in the Animal Juices, with those of the Morbid Animal from which they exhale, as we find in the *Small-Pox*, *Measles*, *Saliva of a Mad-dog*, and the like.

This

This then being the Disposition of the Blood and other Juices, in those Fevers which we call Pestilential, it is evident, that whatever the particular Substance of the Contagious Particles may be, they must be endued with such Qualities as will Coagulate the Animal Juices, Stimulate the *Fibres* to frequent Vibrations, cause Obstructions in the Capillary Vessels, and render the Blood and other Juices of the Body exceedingly Acrid and Pungent, as appears from hence and the foregoing Propositions ; The Symptoms and Consequences (*ceteris paribus*) being the same, whether the Disease has gradually grown up to this Height, or took its Rise only from Contagious Particles brought from abroad.

This is the Method by which I suppose these Contagious and Pestilential Particles to be first generated and produced, in those places which are most subject to them, and thence propagated first into the Neighbourhood, and afterwards to greater Distances by way

of Intercourse and Commerce. The Pestilential *Effluvia* being pack'd up and conveyed in Goods of a soft and loose Texture, as Silk, Wool, Cotton, and the like; And so much the more easily, as the Air into which these infected Materials are brought, is predisposed to act in full Concert with them; as happens in all Places at some times more than others; At which time if these infectious Particles be communicated, they exert their Rage with the utmost Violence, but frequently are either dissipated and lost, or produce Diseases of less fatal Consequence, in an opposite Disposition of the Air.

*Why the
Plague
ceases.*

Thus hard Frost, strong cold and Northerly Winds, are found frequently to put an End to, or at least bridle the Fury of Contagious Diseases, and render them more mild and curable, as was observable in the Beginning of the last great Plague in *London* (m), and frequently taken Notice of in other Places by the

(m) *Hodges de Peste.*

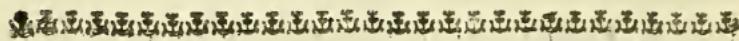
Wri-

Writers on this Subject. Consonant to this we find in *Egypt*, that the Rising of the *Nile* by giving a fresh Motion to, and altering the Disposition of their stagnating and putrid Air, by the mild Vapours and Nitrous Exhalations (*n*) issuing from it, immediately checks the Raging of the Plague, and reduces it to a Fever of a more mild and curable Nature ; insomuch that as *Purchas* and others inform us, if there die in *Grand Caire* 500 Persons of the Plague the Day before, yet upon the Increase of the River it ceases to be Pestilential, and none die of it (*o*). And indeed it can hardly be imagin'd, how the Plague when it has once got establish'd in any Place, shou'd cease but with the Destruction of all or most of the Inhabitants, was it not checked by some Alteration in the Disposition of the Air, and gradually reduced to a Fever of a more mild and curable Disposition.

(*n*) *Boyle's* determ. Nat. Effuv. cap. 4. *Plot's* Nat. Hist. of *Staffordsh.* cap. 2. pag. 42.

(*o*) *Purchas Pilgrim.* lib. 6. cap. 7. *Sandy's Travels*, lib. 2. cap. 97.

It will I think be needless to show, that the Distempers here treated on are propagated by Contagion; But it may not be altogether unnecessary to explain by what Methods these Alterations in the Animal Oeconomy are brought about, and especially as the Means by which they are chiefly communicated, have not that I know of been fully examin'd.



C H A P. IV.

*Of a Pe-
nilence by
Contagion.* **T**HE Contagious Particles whether they be generated in the Air, or produced by the *Effluvia* of Morbid Bodies, being sustain'd in it, are thereby applied to the Surface of our Bodies, with a Force equal to the Pressure of the Incumbent Atmosphere. This Pressure upon the External Superficies of a human Body of a middle Size, has been demonstrated to be equal to 39900 Pounds Troy-weight, and consequently supporting the Body in every Part encompassed with

with these Particles, the whole Force with which all these Particles are on this Account propell'd into the Body, will amount to the aforesaid Sum. But every single Particle is only applied with the Force of a Column of Air of the Height of the Atmosphere, and whose Base is equal to the Surface of that Side of the intruding Particle, opposite to the cutting Angle. Now the Contagious Particles from their extream Smallness and pungent Angles, may not only be consider'd as Bodies applied to us with the preceeding Force, but likewise as so many small Knives or Lancets, acting upon and penetrating the Coats of the Lungs and Surface of our Bodies, with a Force proportional to the Smallness of their cutting Angles. This appears not only from several Propositions in Mechanics, but even to our Senses, by the strong Contraction of a Cord or Fiddle-string in moist Weather. The Particles of Water from their exceeding Smallness, being protruded into the Cord, with a Force capable of Raising

sing the greatest Weights. Now if to these be likewise added the strong attractive force of these small Volatil Particles, occasioned from their Exiguity, it will be no difficult matter to conceive, that they are capable of penetrating the Vessels of our Bodies. Thus the Attractive Force of the Magnet is greater in Proportion to its Bulk, in Small ones, than in those of a larger Size, from the greater Proximity of all its Particles to each other. And 'tis on this Account that Sir *Isaac Newton* computes the Attractive Force of the Particles of Light, to be to that of other Bodies, as 1000000000000000 to 1, in Proportion to the Quantity of Matter contain'd in them (*p*).

This I think is sufficient to shew, that these Acrid and Pungent Particles are able to penetrate the Surface of our Bodies, and get into the Blood that way; And indeed Experience it self confirms it in all other Pungent and Acrid Sub-

(*p*) Optic. in fine Quest. 22.

stances;

stances, as *Garlic*, *Cantharides*, *Arsenic*, and all *Pungent and Corroding Bodies*.

But tho' the whole Superficies of our Bodies are Penetrable by these Poisonous Particles, yet the principal Mischief is communicated to the Blood in its Passage thro' the Lungs. For considering the prodigious Number of the Pulmonary Vesicles, into all which the Air enters in Respiration, and likewise the vast Increase of their Surfaces on that Account, and also the greater Force by which these Particles are applied to the Internal Surfaces of the Vesicles in Expiration, in Proportion to that whereby they are applied to other Parts of the Body of equal Superficies; it will evidently appear, that the Contagion is chiefly communicated by these Vessels to the Blood. For it appears by the Barometer, that every Inch Square upon the Surface of our Bodies is pressed upon by a Weight nearly equal to 1800 Drams, when the Mercury stands highest in the Barometer. Now supposing with Dr.

Kiel (q) that both the Lobes of our Lungs contain 226 solid Inches, of which only $\frac{1}{3}$ or 75 Inches are Vesicles. Supposing also the Diameter of a Vesicle to be $\frac{1}{50}$ Part of an Inch, the Surface of the Vesicle will be .001256 and the Solidity .0000043, by which if we divide 75 the Space fill'd by the Vesicles, the Quotient, viz. 17441860 X .001256 the Surface of a Vesicle, gives the Sum of the Surfaces of all the Vesicles, = 21906.976 square Inches. Which Sum being multiplied by 1800, the Number of Drams which every square Inch of the Surface of our Bodies sustains, gives the Weight which the whole Internal Surface of the Lungs sustains by the sole Pressure of the Atmosphere, when the Mercury stands highest in the Barometer, equal to 39442556.800 Drams, equal to 410859.966 + $\frac{64}{96}$ lib. *Troy* weight, as appears from the known Laws of *Hydrostaticks* (r).

Now if to this be added the increased

(q) *Animal Secret.* (r) *Marriote's Hydrostaticks.*
Pressure

Pressure of the Air, against the internal Surfaces of the Vesicles in Expiration, the Force will be found to be still greater. For supposing the Diameter of the *Larynx* to be equal to 0.5 of an Inch ; Supposing also the Pressure of the *Larynx* in an ordinary Expiration, by which the Force of the expired Air exceeds the Pressure of the Atmosphere, to be two Ounces, as has been found by Experiment (s), the Pressure of the Air in an ordinary Expiration upon the Internal Surface of the Vesicles of the Lungs, will on this Account only be equal to 1844736 Drams, or 19216 lib. *Troy* weight, which added to the Pressure on the Vesicles by the Weight of the Atmosphere, amounts to 39444401.536 Drams, or 410879.182 + $\frac{64}{96}$ Pounds *Troy* weight. But the Pressure of the Air on all the rest of the Surface of our Bodies amounts but to 39900 lib. *Troy*, which is to the Pressure upon the Internal Surface of the Lungs, as 1 to 10.297 + $\frac{28882}{39900}$,

(s) Kiel's Animal Secretion, Edit. ult.

and consequently many more of the Contagious Particles will be communicated this way, than thro' the whole Surface of the rest of the Body. The Weights aforemention'd are indeed prodigious, but that is caused by the great Increase of Surface by the Number of the Vesicles: For it is still to be consider'd, that the Pressure upon each square Inch of the Surface of these Vesicles, amounts to no more than the Pressure on every Inch Square on the Surface of our Bodies, except that Increase which is made by the Force of Expiration, otherwise these Vesicles cou'd in no wise withstand so prodigious a Pressure. This Quantity, *viz.* 75 Cubic Inches or thereabouts seems to be emitted from the Lungs in an ordinary Expiration, for I have found by Experiment, that the Lungs in a large Expiration will emit above 160 Cubic Inches of Air. Having my self fill'd an exhausted Receiver of that Size with Air at one Expiration, of the same Density with that of the Atmosphere.

Now

Now if we likewise consider the exceeding Smallness of the Pulmonary Vessels, and also that the whole Quantity of Blood in the Body must necessarily pass this Organ, in order to its being attenuated and made fit for Circulation; It will necessarily follow, that the Alterations made in the Texture of the Blood by the Poisonous *Effluvia*, are communicated to it chiefly thro' this Organ. Besides, the Poisonous Particles do not only Enter into the Blood in greater Quantities in this Bowel, but when carried by these Passages, are capable of doing much more Mischief, than if entering in at any other Part of the Body, in Regard that they are more intimately mixt with it in its Communion. I have insisted the more largely on this Argument, because I find that most who have wrote in this Subject, tho' they do suppose some of the Contagious Particles may be communicated to the Blood this way, yet lay the greatest Stress on the Mixture of these Particles with the *Sæ-*

liva,

liva, which being swallowed carries them in common with our Nourishment. 'Tis not Improbable indeed, that many of these Particles may be this way communicated to the Blood ; but it is as Probable, that many of them which are by this way Communicated, lose much of their Force by their Mixture with the *Bile* and other Juices ; As we see happens in the Poison of the *Viper*, which taken at the Mouth is not deadly, but when mixed immediately with the Blood produces the most violent Symptoms. The same may be observed from many other Substances, which may be safely taken into the Body by the common Passages, as most Acids, Spirit of Wine, and other Substances, but when mixed immediately with the Blood, by Injections into the Vessels of living Animals, produce Coagulations, Convulsions, and Death : The principal Reason which has induced Physicians to suppose, that the Poisonous *Effluvia* are chiefly communicated by these Passages, are those violent Vomiting

mitings which frequently accompany it; But this happens equally in many other Fevers, where there cannot be the least Suspicion of Contagion. The only Objection to what I have here advanced seems to be, That if the Contagion was communicated to the Blood chiefly by the Lungs, the Coagulations wou'd be immediately form'd there, and this Bowel totally obstructed. But if we consider, that the Chief Application of the Air to the Pulmonary Vesicles is in Expiration, immediately after which the Blood enters the *Vena Arteriosa*, whose Branches continually grow wider, and give Space and Time for the Coagulating Particles to act with their full Force, this Objection will of it self fall to the Ground.

The Contagious Particles being by these Means got into the Blood, do thereby Coagulating and Inspissating the more gross and tenacious Parts, and highly Volatilising and Attenuating others of the most Subtil, reduce the Blood into the above-mentioned State. Thus we
see

see that *Milk*, which is the Juice of an Animal, by the Addition of a small Quantity of an Acid Spirit, changes from an equal Texture, to one of a more gross and viscous, as well as more fluid and watry Substance. The like may be observed in the White of an Egg and the Blood of an Animal it self. Analogous to this is that Experiment of *Jo. Bapt. Alprunus*, who examining the Matter of a Pestilential *Bubo* by Distillation, found at first a *Phlegm*, then a more fat and oily Matter, and lastly a Salt ascending into the Neck of the *Retort*. But what was the most Remarkable in this Experiment, was the prodigious Stench upon opening the Vessels, exceeding as he expresses it a Thousand Wounds exposed to the Summer's Heat, and likewise a Salt so exceedingly Acrid and Pungent, as to equal, if not exceed *Aq. Regis* it self (s).

I shall not from hence pretend to determine, that an Acid Salt is the imme-

(s) *Ph. Col.* No. II. p. 17.

diate Instrument of these Changes in the Animal Oeconomy, since the same may be wrought by Spirit of Wine, and other Liquids (*t*); and Experience assures us, that the *Effluvia* proceeding from the putrifying Parts of Animal Bodies, abound with a Volatil Alcaline Salt, as appears by Collecting them by the Bell, or in Distillation, by which they afford some Phlegm, a most Fetid Oil, and exceedingly Pungent and Volatil Salt; But this is sufficiently Evident from what has been said, that whatever the determinate Nature of the particular Particles may be, they do not only Coagulate the Animal Juices, and increase the Bulk of the Particles of the Blood, but render the remaining Part exceedingly Acrid and Pungent.

Consonant to this Dr. *Hodges* has observed a great Affinity between a Pestilential and Scorbutic Habit of Body, and that those whose Blood naturally

(*t*) *Boyl's Hist. Humani Sang.* *Friend's Emo-*
nalogia in Fine.

abounded with Saline Particles, and had the rest Coagulated or Inspissated, as happens in Scorbutic Constitutions, were more grievously affected by the Pestilence; and also that most of those who Recover'd of the late Plague, were very much subject to Scorbutic Diseases: The like I have frequently observed, where the Small-Pox, Measles, &c. seizes those of a Scorbutic Habit.

Nor is the Blood alone affected by its Mixture with these Saline *Spiculae*, but the rest of the Animal Juices also in Proportion, and especially the Nervous Fluid, which consisting of the most fine Volatil and Subtil Parts, will be render'd extreamly Acrid and Pungent: Whence Pain, Sickness, Inflammations, &c. must necessarily succeed.

C H A P. V.

THE Symptoms accompanying a Pestilential Fever are Yawning, Stretching, Coldness, frequently to the greatest Extremity, Shuddering, sudden Pains in the Head, Giddiness, Loathing, Vomiting, a low unequal Pulse, Trembling, great inward Heat, especially about the *Præcordia*, Coldness of the Extremities, uncertain Sweats, Inquietude, Stupor, Delirium, Watching, Convulsions, Carbuncles, Buboes, Livid Vesications, Purple Spots, *Hæmorrhages*, which three last are the certain Forerunners of Death.

But here it is to be observed, that all the preceding Symptoms do not constantly happen to every individual Person who is affected with a Pestilential Fever, but differ both in Number and Degree according to the Degree of Infection, Virulence of the Contagious

Particles, and Constitutions of particular Persons ; Thus the more the Blood is stock'd with Acrid and Pungent Salts, and other Parts render'd Glutinous, Coagulated, or Inspissated, the hotter the Season of the Year, the more violent the Symptoms will be, where the Degree of Infection is equal, and *vice versa*.

Tawning. These are the first Signs of the Seisure Stretching of the fatal Enemy, and take their Rise Lassitude. from the Slowness of the Motion of the Circulating Fluids. For the Viscosity of the moving Fluids being increased, and the *Liquidum Nervorum* degenerating in Proportion thereto, the Weight to be moved will bear a greater Proportion to the moving Force than in a Natural State, and consequently the Animal must be affected with Weariness, as we find it is in all Cases where the Spirits are exhausted and weakned, in Proportion to the Circulating Juices. The other two are the necessary Consequence of this, for the Viscosity of the Fluids rendring them unfit to pass the small Capillary Vessels,

Vessels, the Pressure on the *Fibres* and Vessels will be increased, excite an uneasy Sensation, and stimulate them to more frequent Vibrations, in order to dislodge the Enemy: Whence follows a Contraction of the Muscles, and especially those which serve for Voluntary Motion, and into which the Spirits are most frequently determin'd: Hence then appears the Necessity of such a Method and Medicines as may dilute and dissolve the Cohering Fluids, and especially of such as are taken actually hot, and with large Quantities of Diluters, the great Activity of the Fiery Particles contain'd in them, rendering them much more capable of penetrating into the smallest Recesses of the Body, and disjoining the Coagulated Fluids.

These likewise depend on the too great *Coldness*,
Sbudder-
Cohesion of the sanguineous Particles, on *ing.*
which account the Circulatory as well as the Motion of the intestine Particles of the Blood being diminish'd, and many of the Igneous Particles intangled in the viscous
Co-

Cohesions, a Sensation of Cold must necessarily ensue, and especially in those Parts where the Motion of the Blood is most slow, and its Cohesion increased as happens in the Extremities. The nervous Juice being likewise for the same reason determin'd Irregularly, and in less Quantity into the Muscles, sometimes one, sometimes another of them will be weakly contracted, or a Shuddering will ensue.

A Low, quick, unequal Pulse. These arise from the Secretion of a smaller Quantity of Animal Spirits, and those too unfit to actuate the Heart and other Muscles, whence their Contractions will be more weak, and being stimulated by the Acrimony of the Juices more frequent than in a Natural State. The Derivation likewise of the Nervous Fluid into the Fibres of the Heart being irregular, for the Reasons afore-given, the Motion of the Heart, and consequently of the Pulse, must be weak, quick, and unequal.

These

These are occasion'd partly by the *Loathing,* *Vomiting,* Contagious Particles being drawn in with the Breath, and in their Passage tainting the *Saliva*, which when swallowed Irritates the Nervous Filaments of the Stomach, and partly by the Secretion of a more Pungent and Acrid Matter by its Glandulous Coat; as appears from their spontaneous Ceasing as soon as a Sweat can be procured, and the Discharge of these Acrid Particles promoted by the Perspirable Glands (^(u)), and seldom otherwise.

A *Diarrhœa* is likewise oftentimes a *Diarrhœa.* Concomitant of these Fevers, and ever of most dangerous Consequence in the Beginning of the Disease, inasmuch as it exhausts the Strength of the Patient, and prevents the regular Expulsion of the Perspirable Matter, by which Experience assures us that these Contagious Particles are most effectually discharg'd. These then indicate such Medicines as cleanse the *Prima Vie* from the Conta-

(u) *Sydenham de Peste.*

gious,

gious Particles, and other Crudities lodged in them, blunt the Acrimony of the Saline Particles, and promote the Regular Expulsion of the Perspirable Matter.

Coldness of the Extremities. This is occasion'd by the weak Contraction of the Heart, and greater Viscosity of the Blood in the Extream Parts of the Body, for the Circulating Fluids being prest on every Side by the containing Vessels, the more thin and liquid Part will pass into such Vessels as arise nearest the Heart, and leave the rest more Viscous and unfit for Motion. The Force of the Heart in the extream Parts being also much diminish'd, thro' the numerous Ramifications of the Vessels, the Motion of the Blood will be more slow, the Cohesion of the Particles of the Blood greater, and the Obstructions in the Capillaries more fixt than in other Parts of the Body. Now the Heat of the Body depending in a great Measure on the Attrition of the Particles against each other, this being diminish'd in the Extream

stream Parts of the Body, the other must be lessen'd in Proportion.

This is occasion'd by the greater Intestine Motion and Colluctation of the Particles of the Blood, and the expansive Particles of Heat being in greater Proportion in these than other Parts of the Body, from the more numerous Ramifications and Obstructions of the Vessels, and their Proximity to the Heart, as appears by Prop. 2.

These arise from the same Cause as the Preceeding, the great inward Heat being a constant *Stimulus* to the nervous Parts, and obliging the Sick to seek continuall Change of Place and Posture, in order to abate this uneasy Sensation. These therefore indicate the use of such Medicines as specifically correct the Acrid and Stimulating Particles, restrain the inordinate Effervescence of the Circulating Fluids, and attenuate the Viscous Cohesions, of which kind are diluting and attenuating Acids, temperate Cordials and Anodynes, in such Doses and Proportions

Great inward Heat especially about the Praecordia.

as are agreeable to the Age, Strength, and other Circumstances of the Patient.

This arises from the Inordinate Influx of the *Liquidum Nervorum*, occasioned from its Acrimony, Viscosity, and Quantity, different from those in a healthful State. Whence the Reflux of the Spirits to the Brain will be altogether irregular, and the Representations brought by them Irrational and Inconsistent. As this Symptom may arise as well from the increased as lessen'd Quantity, and different Texture of the Fluids, and Springyness of the Solids ; so Regard must be had to the particular State of the Solids and Fluids in every Individual, for the abating of this Symptom.

Stupor.

This Symptom necessarily supposes the Flux of the Spirits thro' the Brain and Nerves in some Measure intercepted or diminished, and consequently as the preceeding may arise from different and even contrary Causes, but generally in these Cases shews a greater Degree of Coagulation in the Juices than the former,

mer, and consequently of greater Danger from the more numerous Obstructions in the Capillary and Nervous Vessels. Agreeable to which is that Observation of Dr. Hedges, That they who were attended with this Symptom rarely recover'd.

These depend on the same Cause as Trembling, Faultering in the Speech. the former, viz. On the Diminution or Obstruction of the *Liquidum Nervorum*, whereby the Muscles are involuntarily and weakly contracted. As these suppose a more torpid Motion and greater Viscosity of the Fluids, and less Degree of Elasticity in the solid Parts, so the Method taken herein ought to be more active and stimulating than in any of the foregoing Symptoms. Whence Episapsticks, and the most Volatil Attenuating Medicines are more necessarily required, and ought to be oftner repeated, than in preceeding Symptoms.

This is Occasioned by the Obstruction of some of the Capillary Vessels of the Brain by the Coagulated

Part of the Blood, and the wounding of the Nervous Filaments by the Poisonous Saline *Spiculae*. Whence the Blood being resisted in its Motion, must press more strongly against the Sides of the Vessels, and distend them beyond their Natural Diameters, and produce a shooting and throbbing Pain ; and if the Obstruction continue or increase, a Phrensy, Inflammation, Suppuration, and Gangreen of the Part affected. Why this Symptom should be one of the first, as well as a constant Attendant thro' the whole Course of the Disease, appears from Prop. 2.

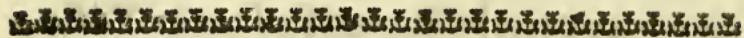
Carbuncles, Boboes, Vesications, &c. Hence likewise appears the Reason of Carbuncles, Boboes, Vesications, and the like, which take their Rise from the same Cause, and are different only in Proportion to the Viscosity or Acrimony of the obstructing Matter, and the Situation and Structure of the Part affected.

Purple Spots, Hemorrhages These show the greatest Corrosion and Acrimony imaginable in the Circulating Fluids, so as to be able to break and destroy

stroy the very Vessels themselves, and consequently certain Signs of a speedy Dissolution of the whole Animal Oeconomy.

The Dissections of such as have died of these Diseases are a farther Confirmation of the foregoing Theory, inasmuch as they demonstrate a greater Acrimony and Coagulation in the Juices than other Diseases, by the numerous Obstructions Inflammations, and Mortifications of different Parts of the Body. Thus the Stomach and Intestines are commonly highly Inflamed, and frequently Gangreen'd. The Lungs, Diaphragm, and several of the *Viscera* inflamed, obstructed, and beset with Carbuncles and Purple Spots. The Arteries of the *Dura* and *Pia Mater* obstructed, and stuff'd with Grumous Blood, and often mortified. The Arteries of the whole Body in general fuller than ordinary, the Veins more empty. The Vessels about *Præcordia* much obstructed, highly inflamed, and often Gangreen'd. The membranous Parts of the Body in general more dry and rigid than in most other Diseases.

CHAP.



C H A P. VI.

Of the S M A L L - P o x.

FROM what has been said of the Nature of Malignant and Pestilential Diseases it will follow, that the Contagious Matter producing the Small-Pox does likewise Coagulate the Blood, and increase the Bulk of its constituent Particles, and that in such a Proportion as are capable of obstructing only the ultimate and perspirable Vessels, as appears, in that it principally, if not solely affects the membranous Parts of the Body, as well External as Internal. Now these Parts being formed of such Vessels, the Pustules could not happen in these more than other Parts of the Body, were not their Vessels thus obstructed, and obstructed they cou'd not be, but from the increased Bulk of the Sanguineous Particles, and

and that in such a Proportion as renders them capable of penetrating into, but not passing thro' the Cavities of the ultimate Vessels, as appears from the preceeding Propositions, and consequently, the contagious Matter producing the Small-Pox, must be indued with this peculiar Property. And indeed if we allow the different Degrees of Coagulation in these Contagious Diseases, and which appear even to our Senses, it will appear, that the Principal if not the sole Difference proceeds only from the greater or less Bulk and Number of the Coagulated *Moleculæ*, and Acrimony of the Coagulating Matter. Thus we see that in Pestilential Diseases; where the Degree of Coagulation and Acrimony of the Juices are superior to the rest, the Obstructions happen in the larger Glands, as are those of the Armpits, Groin, &c. The Circulation of the Blood being obstructed, or at least much retarded in the Capillary Blood Vessels, as appears from the weak Pulse, Coldness of the Extremities, and
the

the like, which constantly accompany it; And consequently the *Moleculæ* form'd by the Coagulation of the Animal Juices must be larger, than these in the Small Pox, which proceed to the ultimate Vessels before the Obstructions are form'd. The *Measles* are another Confirmation of this Theory, whose *Moleculæ* are still less than the preceeding, as appears by their Eruption with greater Flatness, and less Extension of the Obstructed Vessels. Thus also we see that in all these Diseases where the Contagious Matter is more Virulent than ordinary, or the Constitution of the Year more productive of these Diseases, or join'd with a Hot Tense and Scorbutic Disposition, Diarrhea's, Dysenteries, Purple Spots, Hemorrhages, Phrenesies, Convulsions, Inflammations, &c. equally accompany these as Pestilential Diseases.

From what has been said in this and the foregoing Chapters may be deduced the Reasons of the greater or less Virulence of the Small-Pox, Measles, &c. in some

some Years more than others; As also why these Diseases shou'd rage with the greatest Violence when join'd with, or immediately preceeding a Pestilential Constitution of the Air. Hence also appears the Reason why Pains of the Head, Stomach, Loins and Back, preceed the Eruption of the Pustules, these Parts as nearest the Heart being soonest obstructed, and the *Impetus* of the Blood against the obstructed Canals much greater than in the rest of the Body. As also why the Pustules should appear so much sooner in the Face, Neck and Breast, than other Parts of the Body, as appears from Prop. 2.

Hence likewise appears the Reason why the Fever, Vomiting, Pains, &c. preceeding the Eruption of the Pustules should cease or be much diminish'd upon their Appearance; The *Moleculæ*, by the Force of the Circulating Fluids, being driven into and fixt in the Cutaneous Glands, and Secretory Vessels, whereby the Capillary Arteries being freed from

them, a more easy Passage is allowed to the Circulating Fluids. Hence also appears the Reason why the Fever gradually increases with the Augmentation of the Pustules, the Contiguous Vessels being compress'd by their Distention, and the Obstructions in the Secretory Vessels made more Numerous; whence the Quantity of the Perspirable Matter being Diminished, and the Canals streightned, the Vessels will be more full, and the Pulse more strong and frequent. Hence likewise it will follow, that the more numerous the Obstructions are, and more pungent the Contagious Matter, the more Violent the Symptoms will be, and the Matter of the Pustules when suppurrated become an Acrid and pungent gleety Substance, or Laudable *Pus*. As also why the Time of Suppuration shou'd vary in Proportion to the Virulency of the obstrucing Matter; and consequently the Reason of the Difference between the *Distinct* and *Confluent Small-Pox*. Hence also it will appear, that

that Bleeding, in the Beginning of the Disease, ought only to be Administered where the *Impetus* of the Circulating Fluids is so great, that notwithstanding the Diminution of the Force of the Blood by it, the protrusive Force of the Circulating Mass will exceed the *Impetus* made on the Obstructing Matter by the Vibrations of the *Fibres*, and likewise why on its imprudent Use in the Beginning of the Disease, the Pustules shou'd disappear, and be driven back into the sanguineous Vessels. Hence also may be deduced the Reason of the Flux by the Salival Glands, the Swelling of the Face, Hands, and Feet, in the height of the Disease, the Vessels being at this time Turgid by the Suppression of the perspirable Matter; And likewise the Necessity of such Evacuations, as may reduce the Pressure of the Fluids upon them to such a Proportion, as the Tone of the *Fibres* may be able to resist; And why where this is neglected, a *Peripneumonia*, Phrensy, Delirium, &c. do frequently succeed.

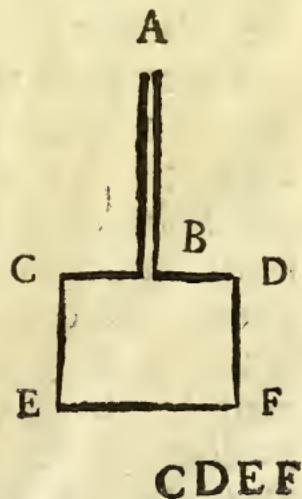
H 2 *Lastlly,*

Lastly, Hence may be deduced the Reason why the Small-Pox shou'd rarely seize those twice, who have had a Competent Number of them. For the Ultimate Perspirable Vessels being distended much beyond their Natural Tone, by the Bulk of the Obstructing *Moleculæ*, the Secretory Vessels must be left wider than before, and consequently less subject to be obstructed by Particles of this Size; Agreeable to this is that Observation of Dr. *Sydenham* and others, That in those Constitutions of the Air where the Small-Pox were very *Epidemic*, many (especially such as attended the Sick) who before had been affected with this Disease, were seized with a Fever in all Respects the same with that attending the Small-Pox, except only the Eruption of the Pustules, and the Symptoms which necessarily attend on them.

T H E
A P P E N D I X.

THE Pressure of the Atmosphere on the internal Surface of the Lungs, as computed in the foregoing Pages, so much exceeding that made by the ingenious Dr. Kiel, in the last Edition of his Book of Animal Secretion, it may not be amiss for the farther Illustration of it, to show that the Weight computed by that Learned Author is not really the whole Pressure of the Atmosphere, but the Force of the Lungs in Expiration, by which they exceed the Pressure of the Air upon them.

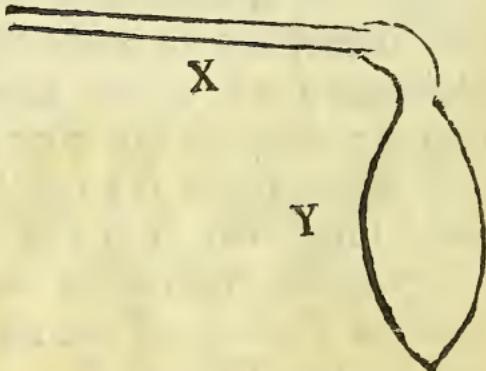
For let the Tube A B be inserted into the Vessel C D E F of any given Dimension, and both the Tube and Vessel fill'd with Water or any other Fluid, it is evident from the Writers in Hydrostatics, that the Vessel



C D E F will be pressed upon on every Part of its Internal Surface equal to the Basis of the Tube, by the Weight of a Column of the contained Fluid of the same Height with the Fluid, and whose Base is equal to that of the Tube, and consequently every Inch Square on the Internal Surface of the Lungs will be pressed upon by a Column of Air, whose Height is equal to that of the Atmosphere, and base one Inch Square, which will amount to the aforesaid Sum. *Vide*

Pag. 34 & 35.

Now if we suppose the Tube X inserted into the Neck of the Bladder Y and the Air forced into the Bladder



in Expiration, to an equal Density with that of the incumbent Atmosphere, it is evident that the Air will not go out by the Tube without some external Force, being in *Aequilibrio* with the Atmosphere, and consequently the Force by which it is expressed thro' the Tube, must be that by which it exceeds the Pressure of the Atmosphere, upon the Orifice of the Tube. If

If any one think that I have allowed too large a Quantity of Air to be taken into the Lungs in an Ordinary Inspiration, That is sufficiently recompensed by supposing the Diameter of the *Larynx* equal to 0.5 and its Orifice 0.19 which is more than it can be, for the Diameter does not exceed 0.4, and consequently its Orifice will be but 0.12. Now it being demonstrated by the Writers in Hydrostatics, that Weights forcing equal Quantities of the same Fluid out of the same Orifice, are to each other as the Squares of the Times in which the Fluid is forced out, and that in equal Times and Quantities of the same Fluid forced thro' unequal Orifices, the weights are Reciprocally as the Orifices; The Powers forcing an equal Quantity of Air thro' the Orifices 0.19 and 0.12 must be to each other in a Reciprocal Proportion, compounded of the Squares of the Times and Orifices of the Tubes; Which will be found sufficient to answer any Objection of this kind, by any who will give himself the Trouble to compute it.

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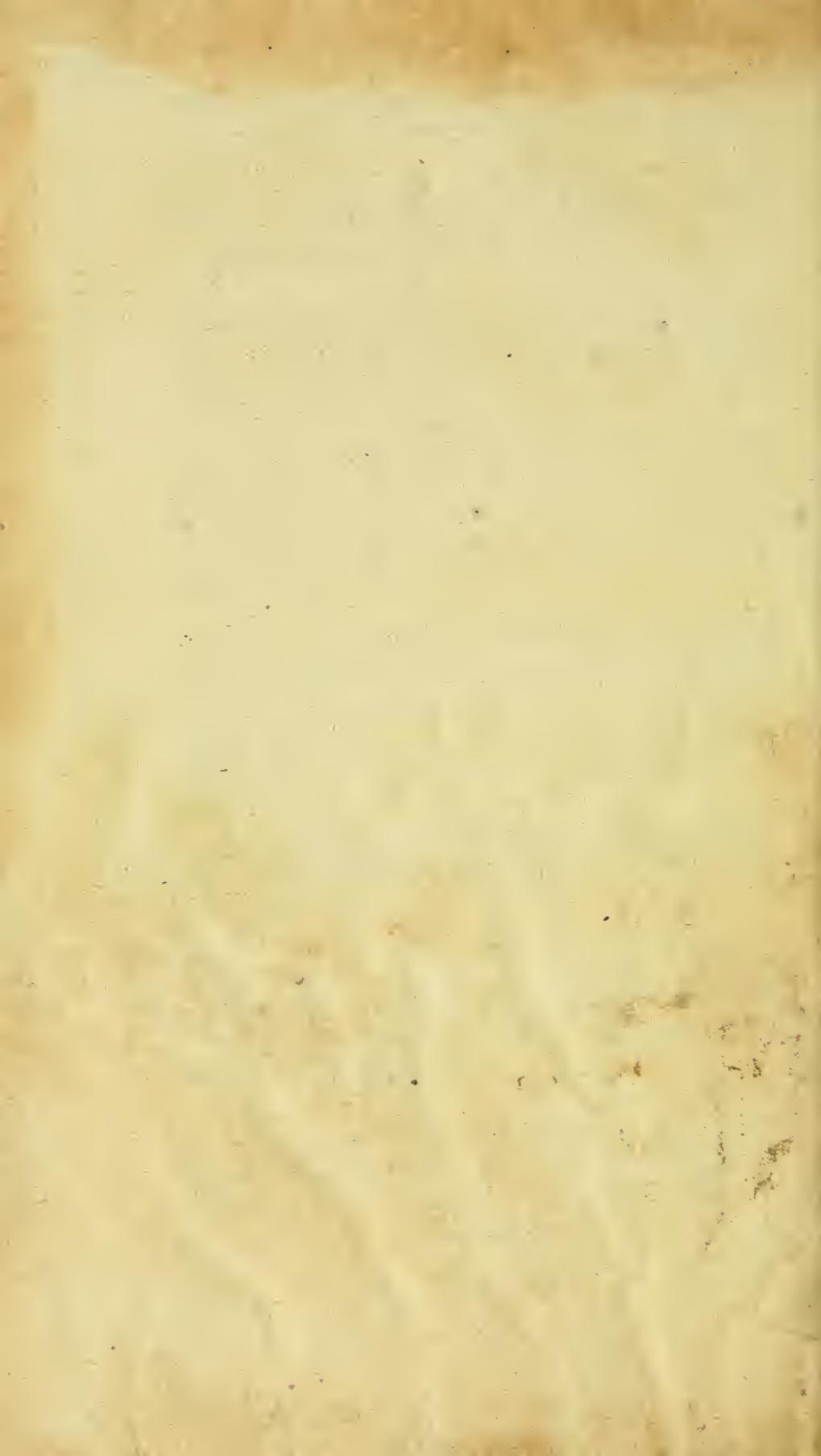
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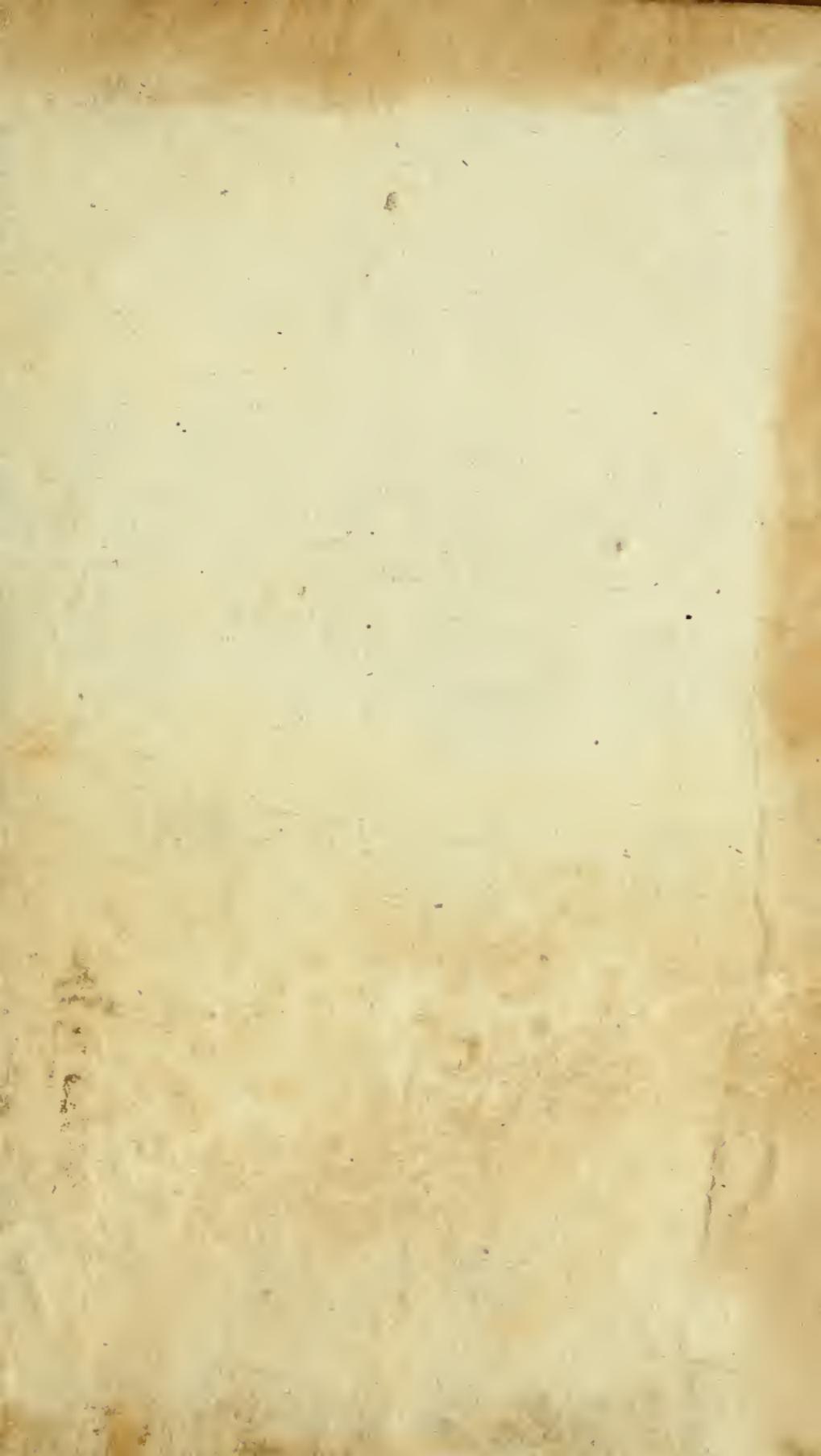
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